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LONG AND SHORT RUN DYNAMICS OF INSTITUTIONAL CREDIT AND PRODUCTIVITY IN AGRICULTURAL SECTOR: EVIDENCE FROM NIGERIA

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ABSTRACT

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This study examined the economic relationship between agricultural productivity and institutional agricultural credit in Nigeria. The two institutionalized credit sources are the commercial bank loans which were proxy as the private sector credit and the government owned Agricultural Credit Guarantee Scheme (ACGS) proxy as the public sector credit while the agriculture's contribution to GDP was proxy as agricultural productivity. To estimate these dynamics, three different ARDL models were estimated, two of which were restricted and the third unrestricted. The first model was restricted to assume that the only credit source is the commercial bank loans while the second model was restricted to assume that the only credit source available is the ACGS and the third assumed the two credit sources were available. The estimate of the models revealed that there is the presence of long run relationship between and among the variables in the models. The long run estimate of Model II revealed that ACGS is not just insignificant with productivity, it also exerts a negative influence at 5%. Model I showed that private sector credit is both significant and positively related to productivity at 5%. Though positively influencing productivity, public sector credit is still insignificant in Model III. In the short run estimates, Model I and III affirms the positive significance of private sector loan to productivity while ACGS remained insignificant in both Models II and III at 5%. The ECT(-1) values of 30.1%, 0.45% and 32.32% of Models I, II and III respectively confirmed the presence of long run relationship in the models and also show the speed of adjustment from short run disturbances to long run equilibrium.

Keywords*: Agriculture; Credit; Productivity; ARDL, Long-run, Short-run, Nigeria*

INTRODUCTION

In Nigeria today, according to Ekwere and Edem (2014), agriculture accounts for one-third of the Gross Domestic Product GDP and employs about two third of the labour force (Oyeyinka, 2002). The Nigeria agricultural policy places the small scale farmers in central focus because Nigeria's agriculture has always been dominated by them and they produce about 90-95 percent of the total agricultural output in the country prior to the advent of the oil boom (Ogieva, 2003). Nigeria was noted for her high production performance in terms of food and cash crops, as well as the supply of most industrial raw materials, which is the product of our small scale farmers. For instance, the total agricultural output between 1986 and 1992 grew at the rate of 0.6 percent per year on the average (World Bank, 1996). However, this important role agriculture played in the Nigeria economy has declined tremendously, and the decline has for a long time been blamed on the neglect of the rural sector, comprising mainly the small scale farmers by successive administration in the country.

Adekoya (2014) posited that a number of scholars (Carter and Wiebe, 1990; Hazarika and Alwangi, 2003) among others have argued that agricultural development is a pre-condition for the development of the Nigerian economy because of the important roles of the sector. The sector employs about two-thirds of the country's total labor force and provides a livelihood for about 90 per cent of the rural population. As such, in order to re-direct the economy and ensure that agricultural production is boosted, several government policy measures have been taken at various times to inject capital into the agricultural sector. From 1973 to date, some of the programs which have been launched by successive governments are Nigeria Agricultural and Cooperative Bank (NACB) established in 1973, Rural Banking Scheme (RBS) established in 1977, Agricultural Credit Guarantee Scheme Fund (ACGSF) established in 1978, Operation Feed the Nation (OFN) established in 1979, and Green Revolution Program (GRP) established in 1981. These programs were meant to avail the agricultural sector the opportunity to use better production technology to pave way for increased agricultural production (Aihonsu, 2001). The Nigeria Agricultural Cooperative Bank (NACB) was later changed to Nigeria Agricultural Cooperative and Rural Development Bank (NACRDB) while Agricultural Credit Support Scheme (ACSS) was introduced in 2006 with the aim of providing credit to farmers, cooperative societies and other rural economic actors to enable them engage in meaningful productive economic activities (Attah, 2008).

According to Ibe (2014), with several uncertainties such as inadequate funding, resource scarcity, heightened risks from climate change, higher energy prices, demand for bio-fuels and doubts about the speed of technical progress, the future of the agricultural sector of the nation's economy remains gloomy. In situations where funds are available, the high interest rate being charged on bank loans; banks' lopsided method of disbursing loans; poor policy implementation, and paucity of funds have been identified as some of the critical challenges facing the

country's farmers. However, Ogunfowora (1993) attributed most of the short comings on institutional credits in Nigeria to factors such as, ineffective supervision or monitoring insufficient funds, political interference, cumbersome and time consuming loan processing, large loan defaults and absence of financial projections. Due to the peculiarities of the agricultural sector like the long gestation periods for agricultural production; the risks and uncertainties from natural causes and the predominance of small scale producers with little asset base and working capital, the sector has continued to receive less attention.

Despite the effort of Nigeria to extend credit facilities to farmers through programs and institutions, the desire to increase agricultural production has been on the increase as the level of production has not been able to meet the local demand thus the present agricultural economic status of Nigeria as a net importer of food and food products. This study therefore seeks to investigate how well institutional credit facilities in Nigeria has impacted on agricultural productivity over time in order to ensure appropriate injection of credit towards sustainable agricultural productivity. The institutional credit facilities in Nigeria include the commercial bank loan to farmers (private sector agricultural credit) and the Agricultural Credit Guarantee Scheme, ACGS (public sector agricultural credit).Two restricted models and one unrestricted model were employed in this study. In the first model, the available credit in the agricultural sector was restricted to the private sector credit, i.e., commercial bank loan while the second model, the available credit was restricted to the public sector credit, i.e., the government owned Agricultural Credit Guarantee Scheme and the third model was unrestricted, taking into consideration the availability of both credit sources. This enabled an in-depth study of how institutional credit sources relate with productivity in the agricultural sector in Nigeria.

METHODOLOGY

Time series data from 1978-2011 sourced from the bulletin of National Bureau of Statistics (2014) were employed for this study. The data of Gross Domestic Product of agriculture, commercial bank loan to agriculture and volume of government loans disbursed under the ACGS scheme were extracted. Due to the spurious nature of many of the time series data, the Augmented Dickey Fuller Unit root test was carried to ascertain whether the data for each of the variables contained unit root. The ADF test is carried out by estimating:

$$\Delta Y_t = \propto + \rho Y_{t-1} + \sum_{i-1}^{j} Y \Delta Y_{t-j} + U_t \quad \text{----------} \quad (1)$$

The lag length j for the ADF ensure U_t is empirical white noise. The significance of ρ is tested against the null that $\rho = 0$ base on the t-statistics from the estimation of the equation above. The decision rule in ADF unit root test says when ADF > critical value, the hypothesis that the variable has unit root is rejected and thus the variable is stationary. Otherwise, the hypothesis that the variable has unit root is accepted and thus the variable is non-stationary. The variable definition is stated in the table 1 below:

Table 1: Description of variables

Variable	Description
Dependent variable	
InAgric	Natural logarithm of contribution of Agriculture to Nigeria's economic growth
Independent Variables	
InCBLTA	Natural logarithm of commercial bank loan to agricultural sector.
InACGS	Natural logarithm of agricultural credit guarantee scheme loan

Therefore, the result of the ADF is therefore stated in the table 2 below:

Table 2: Unit root test result

Variable	ADF Statistics		Critical values			Order of Integration
	Levels	1st Difference	1%	5%	10%	
InAGRIC	-1.45	-4.40**	-3.65	-2.96	-2.62	I(1)
InCBLTA	-1.15	-6.21**	-3.65	-2.96	-2.62	I(I)
InACGS	1.03	-5.85**	-3.65	-2.96	-2.62	I(1)

**stationary at 5% (Author's Computation via Eviews 9)

ARDL Bounds Testing

The Autoregressive Distributed Lag (ARDL) Model which according to Pesaran and Shin (1999) and extended by Pesaran et al (2001) is able to estimate both long and short run dynamics in a single model was adopted for this study. The ARDL functional relationship is stated in the equation below:

$$\text{InAgric} = \beta_0 + \beta_1 \text{InCBLTA} + \varepsilon_i \quad \text{----------} \quad (2)$$

$$\text{InAgric} = \beta_0 + \beta_1 \text{InACGS} + \varepsilon_i \quad \text{----------} \quad (3)$$

$$\text{InAgric} = \beta_0 + \beta_1 \text{InACGS} + \beta_2 \text{InCBLTA}\ \varepsilon_i \quad \text{----------} \quad (4)$$

Where:
$\beta_0, \beta_1 and\ \beta_2 = constant\ term\ and\ parameter\ coefficients\ respectively$
ε_i = white noise
To estimate the long and short run dynamics in the ARDL models, the general ARDL modelsare hereby given as:

$$InAgric = \gamma_0 + \sum_{i=1}^{n} \gamma_1 InAgric_{t-i} + \sum_{i=0}^{n} \gamma_2 InCBLTA_{t-i} + \beta_1 InAgric_{t-1} + \beta_2 InCBLTA_{t-1} + \epsilon_i \quad (5)$$

$$InAgric = \gamma_0 + \sum_{i=1}^{n} \gamma_1 InAgric_{t-i} + \sum_{i=0}^{n} \gamma_2 InACGS_{t-i} + \beta_1 InAgric_{t-1} + \beta_2 InACGS_{t-1} + \epsilon_i \quad (6)$$

$$InAgric = \gamma_0 + \sum_{i=1}^{n} \gamma_1 InAgric_{t-i} + \sum_{i=0}^{n} \gamma_2 InCBLTA_{t-i} + \sum_{i=0}^{n} \gamma_3 InACGS_{t-i} + \beta_1 InAgric_{t-1} + \beta_2 InCBLTA_{t-1} + \beta_3 InACGS_{t-1} + \epsilon_i \quad (7)$$

Where γ_0 is the intercept,$\gamma_1, \gamma_2, \gamma_3$ are the short-run coefficient, $\beta_1, \beta_2, \beta_3$ are the long-run coefficients and ϵ_i is the white noise.
The ARDL Bound testing was used to investigate the long-run relationship between and among the variables under study according to Pesaran et al (2001). The bound test is based on F-statistics. The F-statistic is used to test for the hypothesis of no presence of co-integration as against the alternative of presence of co-integration which was stated as:
H_0: $\beta_1 = \beta_2 = \beta_3 = 0$, i.e., there is no conitegration among the variables
H_a: $\beta_1 \neq \beta_2 \neq \beta_3 \neq 0$, i.e., there is cointegration among the variables
According to Narayan (2005), if the F-statistic is below the lower bound I(0), the null hypothesis of no co-integration is accepted whereas if it is above the upper bound I(1), the null hypothesis of no co-integration is rejected, therefore, the alternative is accepted. However, if the F-stat falls in-between the lower and upper bound values, the result of the presence of long run relationship becomes inconclusive. The F-statistic is compared to the critical values according to Narayan (2005) due to the small sample size nature of this study. This is based on the fact that the Pesaran et al (2001) critical values are based on large sample size.

RESULTS AND DISCUSSIONS

The number of lags used for his study based on the Schwarz Information Criterion is 4. The calculated F-statistics from the bound test is presented in the Table 3.
From the above results, it can be ascertained that in all three cases, there is long run relationship between and among the variables under study. In other words, whether the agricultural sector of Nigeria is financed by commercial bank alone or government credit, i.e. ACGS, or a combination of the two sources of credit, there is the presence of long run relationship. This therefore confirms the general believe that capital or credit is the lubricant of the agriculture. Without capital, it may be difficult to acquire all other factors of production.

Estimate of Long-run elasticities

With the presence of a long-run relationship in all three models estimated, the elasticities of the long-run relationship is hereby estimated in the following equation:

$$InAgric = \beta_0 + \beta_1 InAgric_{t-1} + \beta_2 InCBLTA_{t-1} + \epsilon_i \quad (8)$$

$$InAgric = \beta_0 + \beta_1 InAgric_{t-1} + \beta_2 InACGS_{t-1} + \epsilon_i \quad (9)$$

$$InAgric = \beta_0 + \beta_1 InAgric_{t-1} + \beta_2 InCBLTA_{t-1} + \beta_3 InACGS_{t-1} + \epsilon_i \quad (10)$$

Table 3: Bound test result for long-run relationship

Critical Values(Restricted Intercept and no Trend)	Lower bound	Upper bound
Model I		
1%	6.027	6.760
5%	4.090	4.663
10%	3.303	3.797
Calculated F-statistics = 30.5614 at k=1	Selected Model: ARDL(1,0)	
Model II		
1%	6.027	6.760
5%	4.090	4.663
10%	3.303	3.797
Calculated F-statistics = 21.7468 at k=1	Selected Model: ARDL(1,0)	
Model III		
1%	6.027	6.760
5%	4.090	4.663
10%	3.303	3.797
Calculated F-statistics = 22.3116 at k=1	Selected Model: ARDL(1,0,0)	

Author's computation via Eviews 9

The result of the estimate is hereby stated in the Table 4.

Table 4: Long-run Estimated Elasticities

ARDL(1,0) selected based on Schwarz Bayesian Criterion				
Variable	Coefficient	Standard Error	T-statistics	P-value
InCBLTA	1.1259	0.0511	22.0462	0.0000**
Model I				
Constant	4.0301	0.3223	12.5048	0.0000**
Model II				
ARDL(1,0) selected based on Schwarz Bayesian Criterion				
Variable	Coefficient	Standard Error	T-statistics	P-value
InACGS	-3.3819	31.4402	-0.1076	0.9151
Constant	49.3929	292.5757	0.1688	0.8671
Model III				
ARDL(1,0,0) selected based on Schwarz Bayesian Criterion				
Variable	Coefficient	Standard Error	T-statistics	P-value
InCBLTA	1.0864	0.1117	9.7288	0.0000**
InACGS	0.0481	0.1207	0.3989	0.6929
Constant	4.1326	0.4174	9.9011	0.0000

Author's computation via Eviews 9
**significant at 5%

In Model II in which a restriction that agriculture is funded by the public credit source, i.e., Agricultural Credit Guarantee Scheme, the long run estimate revealed that the scheme in the long run is not just having an insignificant impact on productivity of the agricultural sector at 5%, it also exerts a negative influence on the productivity. This can be attributed to the inconsistent nature of the government of Nigeria in making adequate funding available for the scheme for onward distribution to farmers. Thus, very little is made available to many farmers. Hence, in the long run, what this portends is that available fund will not be adequate for production in the agricultural sector. This is also explicitly clear in the long run estimate of Model III in which both private and public credit sources are available in the sector. The result shows that InACGS in the long run has no significant relationship with agricultural productivity at 5% though not negative this time. This may be as a result of the effect of the private sector credit being available to the farmers whose contribution is both positive and significant at 5%. Hence, the weakness of the public sector credit is not so obvious. From the estimate of the Model I in which the credit availability in the agricultural sector was restricted to commercial bank loans, there is high significant and positive relationship between commercial bank loans to farmers and their productivity. This may be attributed to the fact that various banks make the funding available and thus enough funds are available for borrowing by the farmers who could meet the requirements.

Estimates of the Short run

To examine the short run relationship of the three long run models, the following error correction models were estimated:

$$\Delta InAgric = \gamma_0 + \sum_{i=1}^{n} \gamma_1 \Delta InAgric_{t-i} + \sum_{i=0}^{n} \gamma_2 \Delta InCBLTA_{t-i} + \beta_3 ECM_{t-1} + \epsilon_i \text{ ----------} \quad (11)$$

$$\Delta InAgric = \gamma_0 + \sum_{i=1}^{n} \gamma_1 \Delta InAgric_{t-i} + \sum_{i=0}^{n} \gamma_2 \Delta InACGS_{t-i} + \beta_3 ECM_{t-1} + \epsilon_i \text{ ----------} \quad (12)$$

$$\Delta InAgric = \gamma_0 + \sum_{i=1}^{n} \gamma_1 \Delta InAgric_{t-i} + \sum_{i=0}^{n} \gamma_2 \Delta InCBLTA_{t-i} + \sum_{i=0}^{n} \gamma_3 \Delta InACGS_{t-i} + \beta_3 ECM_{t-1} + \epsilon_i \text{ ----------} \quad (13)$$

The results are stated in the Table 5. From the short run estimates of the three models, Model II again further confirmed the insignificant nature of the public agricultural credit source, ACGS, with agricultural productivity. In other words, this infers that the volume of loans made available to farmers through the scheme isn't adequate enough as to maximize the potentials agriculture can offer to nations especially the developing nations among whom Nigeria is. In fact, from the estimate of Model III, ACGS is still not also significant just like it wasn't from the long run estimate in the same model while the private credit facility to agricultural sector remains positively significant with agricultural productivity at 5%. From Model I, the private sector credit facility to agriculture is positively significant at 5%. The Error Correction term of each of the model possessed the required negative sign and they are significant at 5% and this confirms the presence of long run relationship in the models. ECT (-1) for Model I, II and III are 30.1%, 0.45% and 32.32% respectively. Hence, Model I, II and III will restore back to long run equilibrium at the speed of 30.1%, 0.45% and 32.32% respectively. Thus, the speed at which Model II within which the restriction that the only source of credit in the agricultural sector is the government managed ACGS was created will restore from short run disequilibrium at a very slow pace.

Diagnostic Tests

Table 5: Short-run Estimated Parameters

Variable	Coefficient	Standard Error	T-statistics	P-value
Model I				
ΔInCBLTA	0.1753	0.0753	2.3264	0.0269**
ECT_{t-1}	-0.3010	0.0372	-8.0939	0.0000**
Model II				
Variable	Coefficient	Standard Error	T-statistics	P-value
ΔInACGS	0.0196	0.0907	0.2167	0.8299
ECT_{t-1}	-0.0045	0.0007	-6.7061	0.0000**
Model III				
Variable	Coefficient	Standard Error	T-statistics	P-value
ΔInCBLTA	0.1751	0.0770	2.2756	0.0304**
ΔInACGS	0.0255	0.0731	0.3485	0.7300
ECT_{t-1}	-0.3232	0.0442	-7.3119	0.0000**

Author's computation via Eviews 9
**significant at 5%

The results of the diagnostic tests are presented in Table 6 below:

Table 6: Residual Diagnostic Test

Test for normality			
Model I			
Jarque-Bera	3.5845	Prob(Jarque-Bera)	0.2746
Breusch-Godfrey Serial Correlation LM Test			
Obs*R-squared	0.3932	Prob.Chi-square(2)	0.8215
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Obs*R-squared	1.5174	Prob.Chi-square(2)	0.4683
Model II			
Jarque-Bera	3.0599	Prob(Jarque-Bera)	0.2255
Breusch-Godfrey Serial Correlation LM Test			
Obs*R-squared	1.1054	Prob.Chi-square(2)	0.5754
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Obs*R-squared	5.7096	Prob.Chi-square(2)	0.0576
Model III			
Jarque-Bera	2.0109	Prob(Jarque-Bera)	0.3659
Breusch-Godfrey Serial Correlation LM Test			
Obs*R-squared	0.4043	Prob.Chi-square(2)	0.8170
Heteroskedasticity Test:Breusch-Pagan-Godfrey			
Obs*R-squared	2.9015	Prob.Chi-square(3)	0.4296

Author's Computation via Eviews9

From the above, the table indicates that the model is free from serial correlation, normally distributed and free from heteroskedasticity.

Stability tests

As proposed by Brown, Dublin and Evans (1975), the CUSUM and CUSUMSQ tests were used to examine the stability of the model. The tests applied to the residuals indicate stability in the coefficients over the sample period. The CUSUM test is applied to the cumulative sum of the recursive residuals while the CUSUMSQ is applied to the squared recursive residuals. If the plot of the cumulative sum goes outside the area of 5% critical lines, the parameter estimates are found not to be stable. The same is applied to the CUSUMSQ test. The test results are graphically presented below:

The CUSUM and CUSUMSQ tests results for the three models as shown above revealed that the mean and variance of Models I and III are stable at 5%. However, while the CUSUM of Model II is stable at 5%, the CUSUMSQ is relatively stable at 5% as the statistic was out of the critical bounds between 1998 and 2003[1].

[1]This may be due to the shift in the attention of policy makers in the country towards political stability than development. 1998 was the year the military began the plan to return the country to democratic rule while the first term of four years which ended in 2002 was spent settling the country down politically. Hence, the public source of agricultural credit was also a victim of lost focus.

Model I

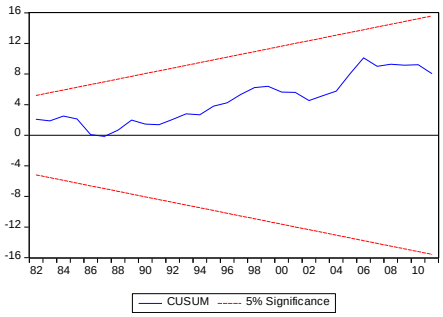

Fig. 1a: Plot of CUSUM test

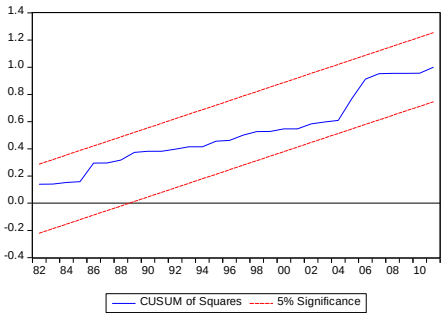

Fig. 1b: Plot of CUSUMSQ

Model II

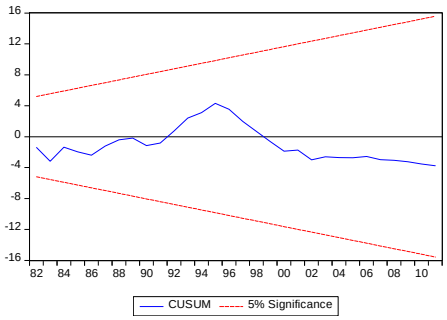

Fig. 2a: Plot of CUSUM test

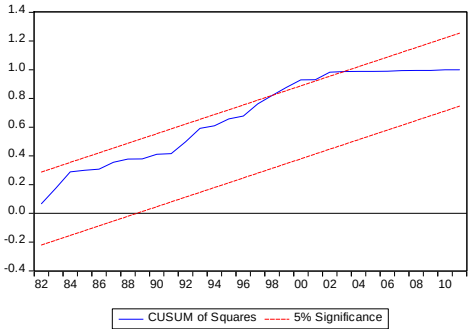

Fig. 2b: Plot of CUSUMSQ

Model III

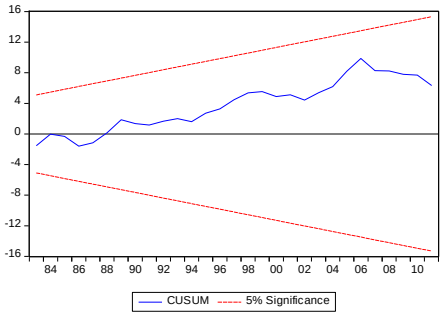

Fig. 3a: Plot of CUSUM test

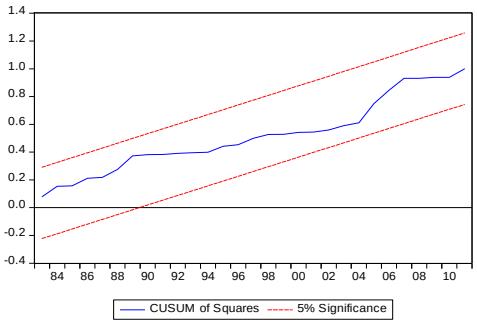

Fig. 3b: Plot of CUSUMSQ

SUMMARY AND CONCLUSION

This study has examined the long and short run relationship of both public and private credit sources to the agricultural sector of Nigeria's economy between the period of 1978 and 2011. The impact of agricultural credit on agricultural productivity was examined in three ways by creating restrictions in two of the models. Model I was restricted to agricultural sector having access to only private credit source, Model II was restricted to the sector being serviced by only the public credit source while Model III was examined without restriction – the impact of the two credit sources available in Nigeria to the agricultural sector was examined on its productivity. The two sources of credit in Nigeria are the commercial bank loan – private credit source and the Agricultural Credit Guarantee Scheme – public credit source.

This study found out that there is a long run relationship in the three models examined. Model I revealed that should commercial bank loan be the only credit source to agriculture in Nigeria, it has a positive and significant relationship with agricultural productivity. Thus, commercial bank loan positively impact agriculture in the long run. However, Model II revealed that the long run relationship between agriculture and public credit source restricting the available credit source to ACGS is not significant. The long run estimate of Model III also confirms that the relationship between public sector credit and productivity is not significant while commercial bank loan maintained the same outcome as in Model I as having both positive and significant relationship with agricultural productivity. The insignificant impact of the public agricultural credit on agricultural productivity can be attributed to lack of adequate monitoring of loan use by the government.

Again, from the short run estimate of Model II with restriction that the only source of credit is the government loan, the government owned agricultural credit does not have significant relationship with agricultural productivity. Also, from the short run estimate from Model III which is without restriction, ACGS does not have significant relationship with agricultural productivity while the commercial bank loan in the same model has a significant relationship with productivity. In Model I with the restriction that the only source of credit to agriculture is the commercial bank loan, there is a significant short run relationship with agricultural productivity. This is because the banks make available substantial amount of money to farmers who approach them for loan and they provide necessary support to beneficiaries of their loans so as to make maximum profit from the use of the loan as compared to the loans made available by the government which are not enough for farmers to engage in profitable production and also lacks monitoring.

The government of Nigeria should ensure that adequate amount of money is made available for onward borrowing to the farmers for production. In fact, the number of beneficiaries of ACGS loan should be managed vis-à-vis the amount of money available. It is more profitable to extend loan of ₦100, 000 to 1,000 small scale farmers than to extend ₦20,000 to 5000 small scale farmers. This will ensure that farmers have the required purchasing power to employ other factors of production. The government should also ensure proper monitoring mechanism for her loans to ensure that the benefiting farmers use the funds for agricultural production. While the volume of loan from the commercial banks has been shown to have significant impact on agricultural productivity, the high interest rate restricts its access to those who can meet the collateral requirements and repayment capacity. Hence, the government can persuade the commercial banks through the apex bank to make interest rate for agricultural loans single digit and relax the required collateral. This will endear more farmers to apply for commercial bank loans.

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